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Request for examination according to § 44, Patent Act, has been submitted.

(54) System for continuous coating of metal ribbon

(57) The invention concerns a mechanism for continuous coating of metal ribbon, such as zinc-coating of steel ribbon, with a bath of the coating material through which the metal ribbon passes, such that there is a reversing roll and at least one adjustable guide roll for the metal ribbon in the coating material bath under the level of the melt, and such that at least one of the rolls (1) is mounted in a roll pivot (7) made specifically of stainless steel in a roll arm (11) mounted on a bearing housing (3, 10). To improve the operating reliability of the system, the invention provides that bearing boxes (6) comprising specifically non-abrasive, particularly ceramic, material are placed in recesses in the roll pivots (7) extending axially from the bearing housing (10), forming supporting surfaces for a ceramic bearing shell (4) mounted in the bearing housing (10).

[insert figure]

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Description

The invention concerns a mechanism for continuous coating of metal ribbon, such as zinc-coating of steel ribbon, with a bath of the coating material through which the metal ribbon passes, such that there is a reversing roll and at least one adjustable guide roll for the metal ribbon in the coating material bath under the level of the melt, and such that at least one of the rolls is mounted in a roll pivot made specifically of stainless steel in a roll arm mounted on a bearing housing.

A mechanism of this type is known from the state of the art (German Patent 30 14 651). In such a mechanism, the metal ribbon being coated is introduced into the coating material bath from outside. In the bath, it is reversed and guided by a "two-roll" or "three-roll" guide arrangement so that it emerges vertically from the coating material bath and the material from the coating material leaves the surface of the ribbon under the influence of blowoff nozzles which strip excess coating material. In this mechanism, a high tensile stress acts in the vicinity of the reversing or guide rolls because the roll guides must attain high positioning accuracy to achieve the best possible coating quality. In the known mechanism, the reversing or guide rolls are mounted with roller bearings or friction bearings on the stainless steel roll pivot. Wear in the vicinity of the bearing is elevated because of the high tensile force acting on the ribbon and by the high peripheral speed, the bath temperature, and undissolved metal particles in the coating material bath. As a result, the positioning of the ribbon between the blowoff nozzles becomes inaccurate and finally the operation of the mechanism must be interrupted to replace the bearing. Such interruptions cause the mechanism to have high down time.

Starting from that point, the objective of the invention is to design a mechanism of the type stated initially with higher operating reliability, which is therefore more economical.

This objective is attained according to the invention by placing bearing shells of non-abrasive, especially ceramic, material in recesses in the roller pivots which extend axially from the bearing housing. They form supporting surfaces for a ceramic bearing box supported in the bearing housing.

The invention is characterized in that the roll pivots are mounted in bearing housings supported by bearing boxes of non-abrasive material, especially ceramic. That substantially extends the operating life of the roller bearing. This mechanism also has the advantage that the adjustment of the ribbon with respect to the nozzle framework need not be changed even after long operation, so that the coating quality remains constant.

The ceramic bearing shell is supported with its cylindrical inner side on the support surfaces of the bearing box. It has at least one partially spherical outer surface with which it is guided into the bearing housing. That produces, firstly, a friction-resistant contact between the inner

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side of the bearing box and the bearing boxes which it supports and, secondly, an axially secured mounting between the outer jacket of the bearing shell and the bearing housing, while angle changes produced by roll movements are possible.

If the inner side of the bearing housing next to the cover surface is given a non-abrasive, particularly a ceramic, coating, according to another embodiment, the liquid coating material is prevented from hardening in the gap between the bearing box and the bearing housing.

Preferably, several bearing boxes are arranged evenly peripherally on the roller pin.

According to the invention, the geometry of the bearing boxes can have several variants. In all the variants, the bearing box has its guide surface opposite to a plane base surface with which it is placed in the appropriately formed recess in the roll pin. If, supplemental to that, the lateral surfaces of the bearing box are mutually plane parallel, that yields a simple structural form.

Conversely, insertion of the bearing box into the recess in the roll pin is made easier if the lateral surfaces are tilted so that the bearing box narrows toward the center of the roll pin.

The reverse situation occurs if the bearing box is broader toward the center of the roll pin. There is better security against centrifugal force separating the bearing box from the roll pin. In this case, the bearing boxes are secured against centrifugal force with a swallow-tail connection.

Another preferred embodiment of the invention provides, in order to fix the roll axially, a clip made in one piece with the bearing housing, axially opposite a thrust washer made of a non-abrasive material, particularly ceramic.

Another preferred mechanism has the bearing housing made in two parts, a lower part fastened to the roll arm, and an upper part of the housing designed as the cover. This allows a simple structural shape and good accessibility to the bearing housing.

To secure the bearing shell radially, it can be advantageous to provide that the spherically shaped bearing shell is secured in the bearing housing by a holding pin.

It is also preferred for the holding pin to be inserted in a hole in the bearing shell with tolerance. In this way, a certain tolerable angular displacement can be taken up.

The invention is particularly characterized by the fact the ceramic bearing can easily be replaced by an ordinary bearing, so that existing machines can be re-equipped appropriately.

The invention is explained in the following by means of an example embodiment.

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Figure 1 shows a section through a first example embodiment of the invention.

Figure 2 shows a section along the line A-B in Figure 1,

and

Figure 3 shows a section corresponding to Figure 2 in a detail view with different designs of the bearing box.

In Figure 1, there is a roll **1** which can be both a reversing roll and a guide roll for an ordinary three-roll or two-roll mechanism. Roll **1** is connected to a stainless steel roll pin **7** and inserted with it into a bearing housing **10** described in the following.

The bearing housing **10** is welded to a roll arm **11**. A clip **12** for the axial bearing is also made in one piece with the bearing housing **10**.

The bearing housing **10** comprises a lower housing part connected with the roll arm **11** and the clip **12**, and an upper housing part, which is removable, designed as the cover **3**.

As is particularly clear from Figure 2, inside the bearing housing **10** there is a bearing shell **4** having a cylindrical inner surface and a spherical outer surface. The spherical form of bearing shell **4** is reduced only by two opposite spherical caps in the vicinity of the axial ends of the bearing.

In the cover surface of the bearing shell **4** there is a hole into which a holding pin **5** is inserted with tolerance. It also enters a recess in the cover **3** of the bearing housing **10**, serving as the radial security for the sphere.

Axially at both sides of the bearing housing **10** there are holding rings **2**, **8** which secure the bearing box **6** radially, with the farther holding ring **8** also providing axial security. A thrust washer **9** provides axial security of the roll **1**. It is placed opposite the free end of the clip **12** for the axial bearing.

The bearing shell **4** comprises highly abrasion-resistant material, such as ceramic.

As also appears from Figure 2, bearing boxes **6** are placed in recesses in the roll pin **7**, evenly spaced circumferentially. The bearing boxes **6** likewise comprise highly abrasion-resistant material. The bearing boxes **6** extend axially past the entire width of the bearing housing **10** and each has supporting surfaces on its outer side, which are supported on the inner surface of the bearing shell **4**. This forms a linear bearing.

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Figure 3 shows four variants, I to IV, for development of the geometry of a bearing box 6. In all the variants shown, the bearing box 6 has its guide surface opposite a plane base surface 6a with which it is inserted in the appropriately shaped recess in the roll pin 7. The embodiments of the variants I to III in Figure 3 differ in that the side surfaces of the bearing box 6 in Variant I are mutually plane parallel. In contrast, Variants II and III are characterized in that the lateral surfaces are mutually tilted. In Variant II the tilt is such that the bearing box narrows toward the midpoint of roll pin 7, while in Variant III it broadens.

Variant IV differs from Variant I only in that additional radii are provided in the connecting region between the supporting surface and the lateral surfaces 6b.

The function is described in greater detail in the following:

When the roll 1 rotates, with corresponding rotation of the roll pin 7, the bearing boxes 6 turn with it, correspondingly. The bearing boxes 6 are supported on the inner surface of the bearing shell 4 in the axial direction.

Through the design of the structural elements, the roll bearing of ceramic material according to the invention gives a substantial reduction in wear.

List of reference figures:

- | | |
|----|-------------------------------------|
| 1 | Roll |
| 2 | Holding ring |
| 3 | Housing cover |
| 4 | Bearing shell |
| 5 | Holding pin |
| 6 | Bearing box |
| 6a | Base surface of the bearing box |
| 6b | Lateral surfaces of the bearing box |
| 7 | Roll pin |
| 8 | Other holding ring |
| 9 | Thrust washer for the axial bearing |
| 10 | Housing |
| 11 | Roll arm |
| 12 | Clip for the axial bearing |

Patent Claims

1. Mechanism for continuous coating of metal ribbon, such as zinc-coating of steel ribbon, with a coating material bath through which the metal ribbon runs, having a reversing roll below the level of the melt in the coating material bath and at least one

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adjustable guide roll for the metal ribbon and in which at least one of the rolls (1) is mounted by means of a roll pin (7), particularly one of stainless steel, in a bearing housing (3, 10) supported by a roll arm (11), characterized in that bearing boxes (6) of non-abrasive, especially ceramic, material, which form supporting surfaces for a ceramic bearing shell (4) mounted in the bearing housing (10) are placed in recesses in the roll pin (7) extending axially with respect to the bearing housing (10).

2. Mechanism according to Claim 1, characterized in that the bearing shell (4) has a spherical covering surface with which it is axially secured in the bearing housing (10).
3. Mechanism according to Claim 2, characterized in that the inner side of the bearing housing (10) adjacent to the covering surface is given a non-abrasive, particularly a ceramic, coating.
4. Mechanism according to one of the foregoing claims, characterized in that multiple bearing boxes (6) are arranged evenly peripherally on the roll pin (7).
5. Mechanism according to Claim 4, characterized in that the bearing box (6) has its guide surface opposite to a flat base surface (6a) and that its lateral surfaces (6b) are mutually plane parallel.
6. Mechanism according to Claim 4, characterized in that the bearing box (6) has its guide surface opposite to a flat base surface (6a) and that its lateral surfaces (6b) are tilted toward each other.
7. Mechanism according to Claim 6, characterized in that the lateral surfaces (6b) are tilted toward each other so that the bearing box (6) narrows in the direction of the center of the roll pin (7).
8. Mechanism according to Claim 6, characterized in that the lateral surfaces (6b) are tilted toward each other so that the bearing box (6) becomes wider in the direction of the center of the roll pin (7).

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9. Mechanism according to one of the foregoing claims, characterized in that a clip (12) designed in one piece with the bearing housing (10) is provided, axially opposite a thrust washer (9) comprising a non-abrasive material, especially a ceramic material.
10. Mechanism according to one of the foregoing claims, characterized in that the bearing housing (10) is made in two parts, comprising a lower housing part solidly connected to the roll arm (11) and an upper housing part designed as a cover (3).
11. Mechanism according to one of the foregoing claims, characterized in that the bearing shell (4) made as a sphere is radially secured in the bearing housing (10) by means of a holding pin (5).
12. Mechanism according to Claim 11, characterized in that the holding pin (5) is inserted with tolerance into a hole formed in the bearing shell (4).
13. Mechanism according to one of the foregoing claims, characterized in that a first holding ring (2) is provided which laps radially over the bearing box (6).
14. Mechanism according to one of the foregoing claims, characterized in that another holding ring (8) is provided, which laps over the bearing box (6) radially and axially.

Accompanied by 3 pages of drawings

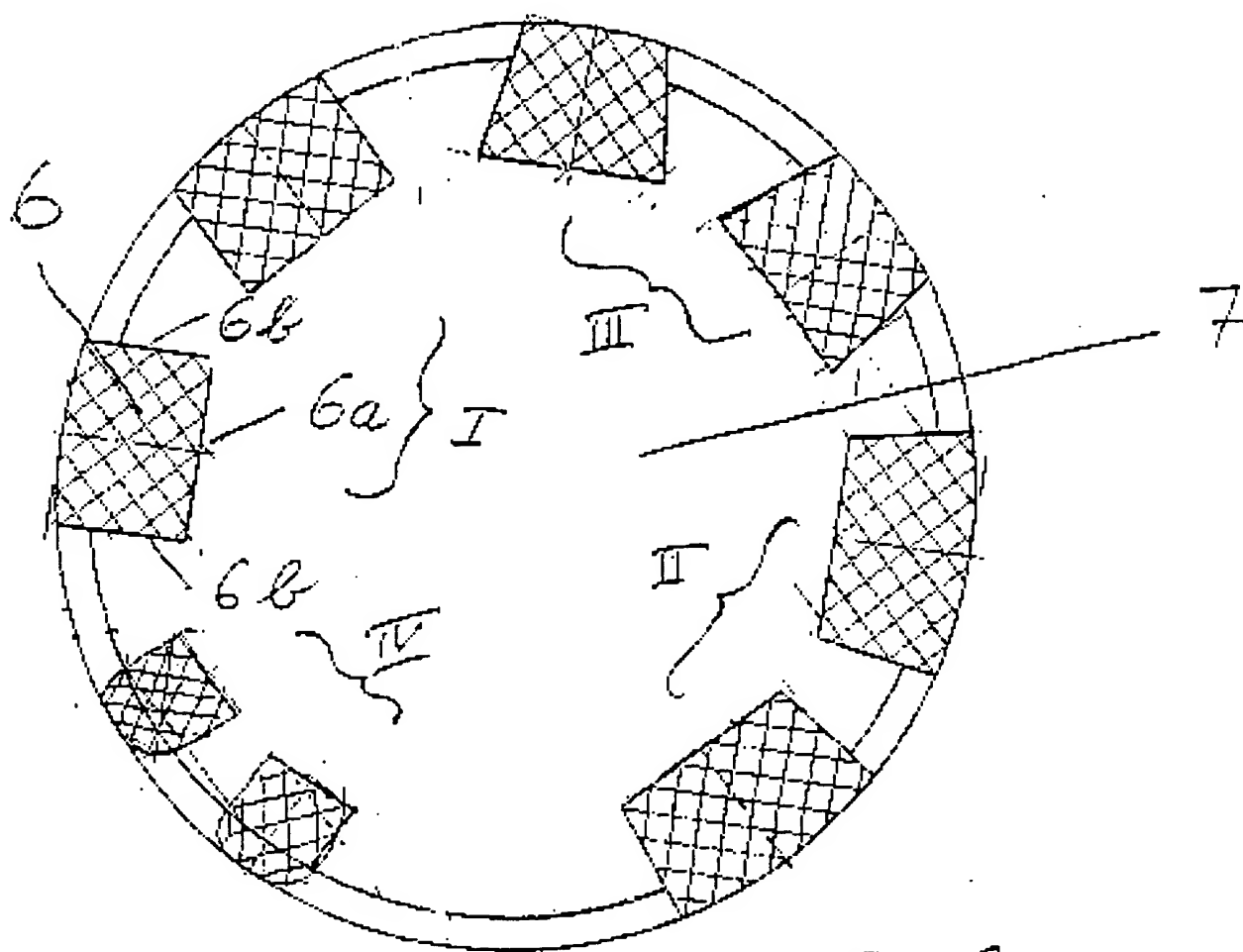


Fig. 3

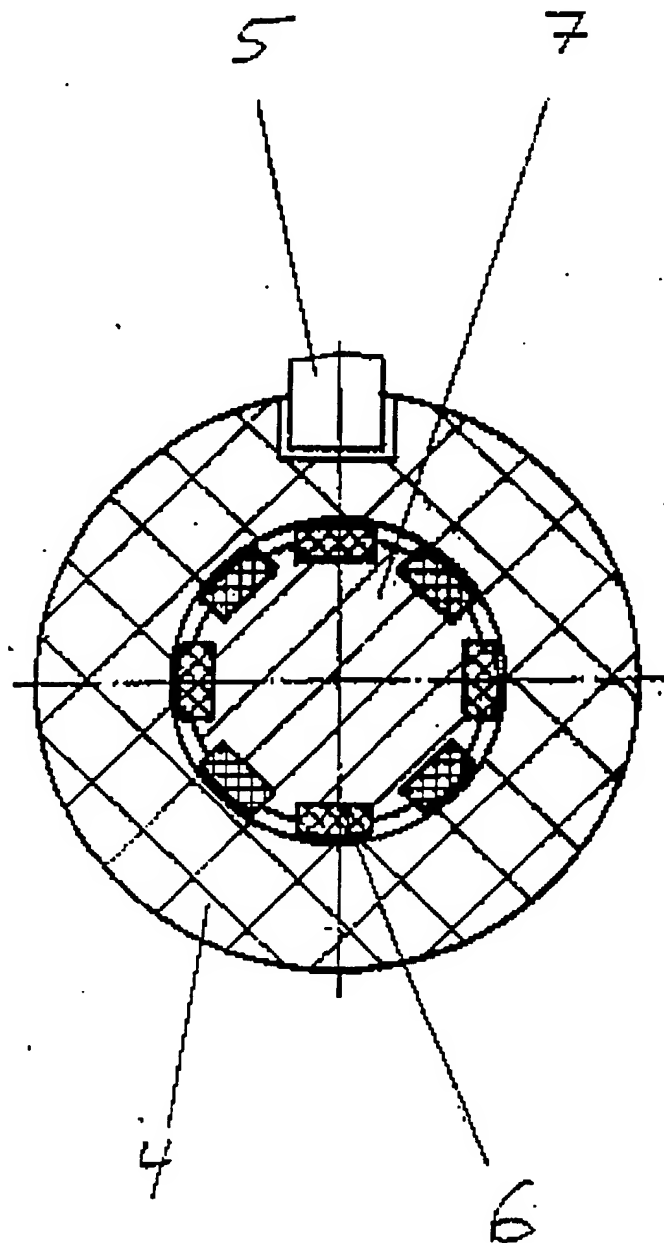


Fig. 2

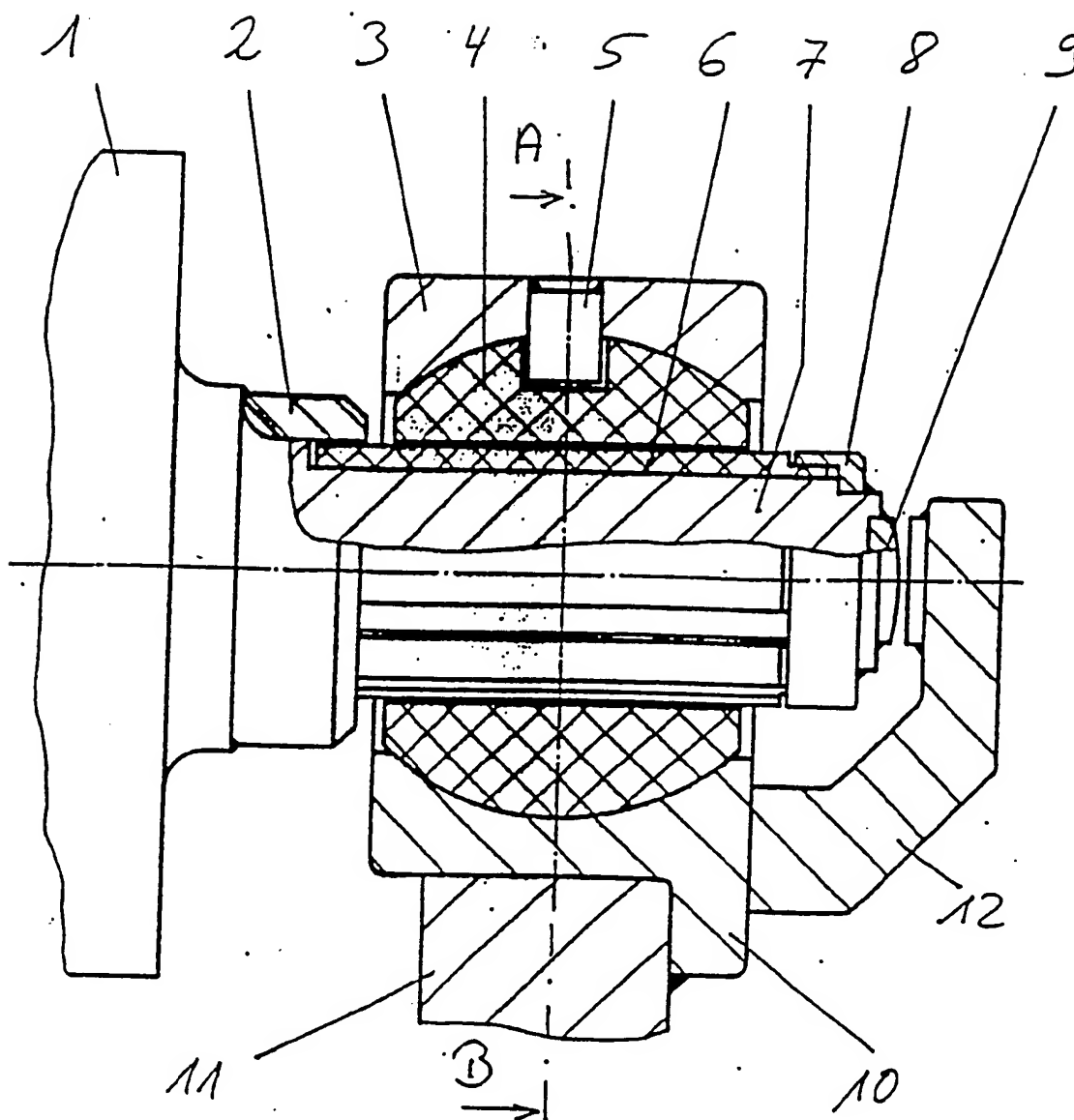


Fig. 1